Patent Claims

1. Method for producing a grating image, which at least has one grating field with visually recognizable, optically variable properties, in which grating elements are disposed, that are produced by means of a writing apparatus, the method comprising the following steps:

   a) determining at least one grating element, which completely lies within one working field;

   b) defining a sequence of working fields, in which the grating elements are to be produced by means of the writing apparatus;

   c) moving to the working fields by relative movement of a carrier, on which is located a substrate to be inscribed, and the writing apparatus;

   d) writing the at least one grating element into the substrate with the writing apparatus within the respective working fields.

2. Method according to claim 1, characterized in that the determination of the grating elements in step a) is effected with the help of a data record, which contains information about form and position of the grating elements forming the grating field.

3. Method according to claim 1 or 2, characterized in that the data record contains the coordinates of the starting points and end points of the grating element.

4. Method according to claim 3, characterized in that the data record contains the coordinates of several intermediate points.

5. Method according to claim 1 or 2, characterized in that the data record contains the coordinates of Bezier curves, which describe the form of the grating elements.

6. Method according to at least one of the claims 1 to 5, characterized in that with the help of the coordinates it is determined, which grating elements can be continuously produced in one writing operation.

7. Method according to at least one of the claims 1 to 6, characterized in that a coordinate window of the size of the working field is defined, and in step b) is put over the coordinates of the grating element.

8. Method according to claim 7, characterized in that starting out from a defined starting point it is determined, which grating elements succeeding each other completely lie in the area of this coordinate window.

9. Method according to claim 7 or 8, characterized in that the coordinates of the grating elements within a coordinate window are sorted in such a way, that polygonal curves are the result.

10. Method according to at least one of the claims 7 to 9, characterized in that all working fields are determined with the help of the coordinate window.

11. Method according to at least one of the claims 1 to 10, characterized in that as a writing apparatus a light beam or a particle beam is used.

12. Method according to at least one of the claims 1 to 11, characterized in that as a writing apparatus an electron beam is used.

13. Method according to at least one of the claims 1 to 12, characterized in that the writing in of the grating elements in step d) is effected by deflection, preferably electromagnetic deflection, of the writing apparatus.

14. Method according to at least one of the claims 1 to 13, characterized in that the size of the working fields corresponds to the size of the deflection area of the writing apparatus.

15. Method according to at least one of the claims 1 to 12, characterized in that when writing in the grating elements in step d) the writing apparatus is mounted stationary and the carrier is moved.

16. Method according to at least one of the claims 1 to 15, characterized in that as a carrier a movably mounted table is used.

17. Method according to at least one of the claims 1 to 16, characterized in that the working fields in step c) are moved to by moving the carrier.

18. Method according to at least one of the claims 1 to 17, characterized in that the grating field has the form of a line.

19. Method according to at least one of the claims 1 to 18, characterized in that as grating elements grating lines are used.

20. Method according to at least one of the claims 1 to 19, characterized in that the grating lines at least in certain areas extend across the width of the grating field.

21. Method according to at least one of the claims 1 to 20, characterized in that the grating lines are formed straight or curved.

22. Method according to at least one of the claims 1 to 21, characterized in that in at least one working field only one grating element is produced.

23. Method according to claim 22, characterized in that in each working field only one grating element is produced and the individual positions of the grating elements along a motion path are moved to by a stepwise or continuous movement of the carrier.

24. Method according to at least one of the claims 1 to 23, characterized in that all grating elements have the same form.

25. Method according to at least one of the claims 1 to 24, characterized in that the grating elements have different forms.

26. Method according to at least one of the claims 1 to 25, characterized in that the grating image has large grating elements, the coordinates of which at least partly lie outside the working field, and that these grating elements are produced according to a different method.

27. Method according to claim 26, characterized in that these large grating elements are produced continuously by shifting the carrier.

28. Method according to claim 26, characterized in that these large grating elements are divided into processing areas, the size of which corresponds to maximally one working field.

29. Method according to claim 28, characterized in that the processing areas are moved to successively by shifting the carrier and the parts of the large grating elements lying in the respective processing area are produced.

30. Method according to at least one of the claims 1 to 29, characterized in that when defining the sequence of the working fields also the processing areas are taken into account.

31. Method according to at least one of the claims 1 to 30, characterized in that the large grating elements are long grating lines, the coordinates of which lie outside the deflection area of the writing apparatus.

32. Method according to at least one of the claims 1 to 31, characterized in that the writing paths of the writing apparatus within the respective working fields or processing areas have a meandering or zigzag shape.

33. Method according to at least one of the claims 1 to 32, characterized in that in a data processing system at first all coordinates necessary for the production of the grating elements are determined, and then the writing apparatus with the help of these coordinates produces the grating elements in the substrate.

34. Method according to at least one of the claims 1 to 33, characterized in that as a substrate a radiation-sensitive material is used, in which the writing apparatus causes a change of state.

35. Method according to claim 34, characterized in that as a radiation-sensitive material a photoresist layer is used.

36. Method according to at least one of the claims 1 to 35, characterized in that onto the substrate provided with the grating elements a metallization is applied, and a metallic molding is galvanically produced therefrom.

37. Method according to claim 36, characterized in that the molding is used as an embossing tool for embossing a grating image into a layer.

38. Method according to at least one of the claims 1 to 37, characterized in that the grating image has several grating fields.

39. Method for defining the coordinates of movement of a writing apparatus and a carrier for producing a grating image, which has at least one grating field recognizable with the naked eye, in which grating elements are disposed, the method comprising the following steps:

- determining the grating elements, the coordinates of which lie within a predetermined coordinate window;
- defining a sequence of working fields, in which the writing apparatus is moved relative to a carrier, on which is located a substrate to be inscribed.

40. Method according to claim 39, characterized in that for determining the coordinates of the grating elements a contour line of the grating field is defined and the contour line is filled with the grating elements.

41. Method according to claim 40, characterized in that the grating elements are grating lines and as grating coordinates the intersection points the grating lines have with the contour line of the grating field are used.

42. Method according to at least one of the claims 39 to 41, characterized in that the method is carried out with the help of a data processing system.

43. Apparatus for defining the coordinates of movement of a writing apparatus and a carrier for producing a grating image, which has at least one grating

field recognizable with the naked eye, in which grating elements are disposed, the apparatus having the following devices:

- a device for determining at least one grating element, which completely lies within one working field;
- a device for defining a sequence of working fields, in which the grating elements are to be produced by means of the writing apparatus;
- a device for defining the motion path of the writing apparatus and/ or the carrier, on which is disposed a substrate to be inscribed, so that the working fields are successively moved to and the grating elements lying in the respective working field can be produced.

44. Apparatus according to claim 43, characterized in that the apparatus has a device for determining the coordinates of the grating elements.

45. Apparatus according to claim 43 or 44, characterized in that the apparatus is a data processing system.

46. Grating image, which has at least one grating field recognizable with the naked eye, in which grating elements are disposed, a greater part of the grating elements having a length of less than 0.2 millimeter, preferably 0.05 millimeter, and being continuous.

47. Grating image according to claim 46, characterized in that the grating elements are grating lines.

48. Grating image according to claim 46 or 47, characterized in that the grating field also has long grating lines with a length of more than 0.02 millimeter.

49. Grating image according to claim 48, characterized in that the long grating lines are composed of several partial sections.

50. Grating image according to at least one of the claims 46 to 49, characterized in that the grating image has several grating fields.

51. Apparatus for carrying out the method according to at least one of the claims 1 to 42.

52. Grating image produced according to at least one of the claims 1 to 42.

53. Security element with at least one grating image produced according to at least one of the claims 1 to 42.

54. Security element with at least one grating image according to at least one of the claims 46 to 50.

55. Security element according to claim 53 or 54, characterized in that the security element is a security thread, a label or a transfer element.

56. Security paper with at least one grating image produced according to at least one of the claims 1 to 42.

57. Security paper with at least one grating image according to at least one of the claims 46 to 50.

58. Security paper with a security element according to at least one of the claims 53 to 55.

59. Security document with at least one grating image produced according to at least one of the claims 1 to 42.

60. Security document with at least one grating image according to at least one of the claims 46 to 50.

61. Security document with a security element according to at least one of the claims 53 to 55.

62. Security document with a security paper according to at least one of the claims 56 to 58.

63. Transfer material, in particular hot stamping foil, with at least one grating image, produced according to at least one of the claims 1 to 42.

64. Transfer material, in particular hot stamping foil, with at least one grating image according to at least one of the claims 46 to 50.

65. Embossing tool with at least one grating image, produced according to at least one of the claims 1 to 42.

66. Embossing tool with at least one grating image according to at least one of the claims 46 to 50.